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ABSTRACT

In Finland, ammattikorkeakoulu (AMK) or higher vocational education institutions or polytechnics are professionally and practically oriented; their teaching and learning methods reflect approaches different from those of universities. Training and learning methods focus on learning by doing. Project work used in polytechnic programs offers students meaningful forms of learning in collaboration with other students, teachers, and representatives of working life. Use of project-based learning varies in different fields of polytechnic programs. Two phenomenographic case studies at three AMK institutions: Kajaani Polytechnic, Jyvaskyla Polytechnic and Helsinki Polytechnic, reveal ways of integrating theory into practice and school- and work-based learning. Results of the case studies indicate that the students' learning goals can be organized into the following four main categories: style of learning; social orientation; professional orientation; and locus of control. Project-based learning develops students' self-regulation, communication, and collaboration skills. (Contains 73 references.) (YLB)

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Work-Based Learning in Vocational Higher Education Programmes: A Finnish Case of Project-Based Learning

by

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Work-Based Learning in Vocational Higher Education Programmes: A Finnish Case of Project Learning

by

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Abstract

Higher occupational education is derived from the need for a highly-trained expert work force in the labour market. As polytechnics are professionally and practically oriented, their teaching and learning methods reflect different approaches from those of universities. Teaching and learning methods focus on learning by doing. Two case studies revealed the ways of integrating theory into practice and school- and work-based learning. Project work used in polytechnic programmes offers students meaningful forms of learning in collaboration with other students, teachers and representatives of working life. However, utilizing project-based learning varies in different fields of polytechnic programmes. As a case, the Department of Health and Social Care at the Jyväskylä Polytechnic launched a development project in 1998. The results of the case study showed that the students' goals of their assignments indicated the following main categories (1) style of learning, (2) social orientation, (3) professional orientation and (4) locus of control. The project-based learning especially developed students' know-how in working life such as self-regulation, communication and collaboration. Conclusions are drawn on interactive mentoring between teachers, teams and students.

Introduction of Vocational Higher Education in Finland

Finland is one of those European countries where the higher education system has two parallel sectors, universities and AMK (ammattikorkeakoulu) or higher vocational education institutions or polytechnics. Universities and AMK institutions complement each other in their respective areas of strength, and each type of tertiary education establishment has their own functions. Universities focus on research and on research-based teaching. AMK institutions represent high-level expertise in working life and its development. Finland has 20 universities and 29 AMK institutions (Ministry of Education, 2000a).

A Finnish AMK (higher vocational education, polytechnic) degree is a tertiary qualification. The studies leading to it are intended to provide graduates with the knowledge and skills needed in expert tasks as considered from the viewpoint of the requirements set by working life and its development (Laki ammattikorkeakouluopinnoista 3.3.1995/255, 2§).The reform of Finnish vocational higher education has been guided by certain principles, summed up as follows:

1. Several specialised tertiary-level colleges have been combined into a multidisciplinary AMK (higher vocational education) institution managed as a consortium of a number of individual educational establishments. It is believed that integrating resources and expanding study programmes the student choice and the option of switching programmes will benefit students more as compared to the programmes previously offered by tertiary-level colleges.

2. AMK programmes lead to baccalaureate degrees. The contents of an AMK degree are halfway between those of university degrees and those of tertiary-level college qualifications. At its best the consortium structure will make possible the flexible provision of new interdisciplinary degree programmes.

3. The aim of enhancing the level of instruction involves above all upgrading teachers' professional skills through additional and further training. There will be improved access to studies leading to a Licentiate or a doctorate. The main task of an AMK teacher is instruction rather than research. Their qualification requirements include also a teaching diploma and broad experience from working life.

4. As regards developing studying methods, the emphasis is on moving from classroom instruction to self-regulated studying, learning through project work, and multiform teaching.

5. As regards the aim of promoting co-operation between education and working life and learning based on this link, the focus is particularly on an obligatory work-based learning period and the thesis. The work-based learning period is a defining component of AMK studies. The thesis entails as a rule solving a problem identified in the enterprises of the relevant field. The success of any AMK institution depends on close links with working life.

6. Internationalisation is promoted through student exchange, courses taught also in languages other than Finnish, and language studies. Most AMK students will be given opportunities to study or work in another country for a certain period of time.
7. Library and information services hade been developed hand in hand with the application of new kinds of teaching and studying method. Networking with other educational establishments will considerably expand the options available to AMK institutions. (Ministry of Education, 1999b.)

These principles have served also as criteria for permissions to found new AMK institutions. The Polytechnics Act (*Laki ammattikorkeakouluopinnoista 3.3.1995/255*) (4§) states that "the Government can grant a municipality or a federation of municipalities a licence to establish an AMK institution" (Luhtanen, 1999, p. 44). Applications for accrediting an AMK institution on a permanent basis were assessed by the Finnish Higher Education Evaluation Council. The criteria to be applied in deciding about accreditation are defined in the Polytechnics Act (5§) as follows: (1) the business idea, (2) relevance of and need for the proposed degree programme, (3) viability of the proposed combinations of study fields, (4) the institution's strengths, (5) adequate size in terms of the proposed educational task, (6) the educational level of teaching staff, (7) library and information services, (8) links with working life, (9) co-operation with universities, other tertiary education institutions and other educational establishments, (10) international co-operation (11) regional education and service task and (12) organisation of evaluation.

The essential question involved in the creation of quality in AMK institutions is how they can justify their existence and establish an identity of their own alongside universities without imitating the latter, and what kind of justification and identity it will be. The uniqueness of and need for AMK institutions depend on what kind of co-operation they will be able to generate with working life and with the regional business and labour centre and how this will benefit their students and each institution's education and training provision. There is a link between developing study programmes and learning and the quality of education. Accordingly, the AMK institutions are concentrating particularly on the promotion of work-based learning. The issue and centrality of learning has increased, and an emphasis of content is on both generic skills and content specific expertise.

AMK institutions have linked their new modes of operation with regional development projects. Institutions' visions reflect their regional roles as developers of working life, industry, commerce; and the region at large. To create contextual and situated learning environments, different project-based learning and working environments have been designed. Little is known about the impact of work-based study methods used in professional education. The present study surveys how faculty on an AMK degree programme in information technology, at an AMK school of business and an AMK department of mechanical engineering assess the significance of work-based learning for developing curricula in their field and what kind of co-operation projects they have with enterprises. Secondly, the study examines students' views of what they learn through project work on a health and social care degree programme, where the systematic implementation and development of work-based learning may have longer roots than in any other field.

Studying at the Finnish AMK Institutions

Finnish higher education caters for a broad range of educational demand. In 1999 the higher education system as a whole had vacant student places for 66 per cent of the average 16-19 age cohort, of which the AMK institutions accounted for 37 per cent and the universities for 29 per cent (Ministry of Education, 1999b). The AMK institutions are mainly multidisciplinary and regional higher education establishments whose activities are centrally based on links with working life. In addition to their educational functions the AMK institutions engage in research and development supplying the needs of teaching and promoting working life.

AMK institutions offer occupationally oriented tertiary qualifications taking between 3.5 and 4,5 years (140-180 credits) to complete. Applicants must have completed general upper secondary school or taken an initial vocational qualification. At the moment, some 70 per cent of the students are matriculated general upper secondary school leavers while some 30 per cent have a vocational qualification. The degree programmes offered by the AMK institutions are approved by the Ministry of Education. Instruction leading to an AMK degree is free.

The teaching staff of the AMK institutions consist of senior lecturers and teachers. Senior lecturers must have a Licentiate or doctoral degree and at least three year's work experience in the occupation they teach. Lecturers must have a MA and, similarly, at least three years' work experience in the occupation they teach.

There are six AMK degree programmes leading to baccalaureate degrees (Ministry of Education, 2000). The degree programmes cover the following study fields (intake in 2000):

- Technology and Transport (33%)
- Business and Administration 28%)
- Health Care and Social Services (21%)
- Culture (e.g. music, craft and design, dance) (8%)
- Tourism, Catering, and Home and Institutional Management (5%)
- Natural Resources (e.g. agriculture, forestry, fishery) (3%)
- Humanities and Education (e.g. leisure activities) (2%)

The AMK institutions are municipal or private establishments. Funding is provided both by the state and the municipalities. The agreements on objectives and results concluded between the Ministry of Education and the AMK institutions define the goals to be pursued and the number of vacant student places to be provided the institutions, and determine the levels of project and productivity funding (Ministry of Education, 1999a).

The AMK institutions also deliver *adult education* consisting of instruction leading to AMK qualifications and of specialisation training of 20-40 credits. In 1999 there were a total of 11,500 students enrolled for degree programmes, with another 3,000 students in specialisation training (Ministry of Education, 1999b). A start has been made also with the provision and development of open AMK instruction, with all AMK institutions now offering it. In 1999 there were some 2,800 students engaged in open AMK studies (Ministry of Education, 2000).

Administration and Financing. Decisions about educational legislation and the general principles of educational policy lie with the Parliament. The Government , the Ministry of Education and the National Board of Education are responsible for implementing this policy on the level of the central government. The Ministry of Education is the supreme educational authority in Finland. Its powers cover education, research, culture, youth welfare, ecclesiastical affairs and physical and sports-related activities and copyright affairs. Its Department for Education and Science Policy is responsible for all forms of education from general education to university and adult education and for scholarly and scientific research. The Department has six divisions: a General Education Division, a Vocational Education Division, a Polytechnic (AMK institutions) Division, a University Division, a Division for Adult Education and Training, and a Science Policy Division.

The AMK institutions are municipal or private establishments. The AMK institutions receive their basic financing from the state (57%) and the municipalities (43%). During the foundation phase of the AMK institutions the state has allocated special funds for their development. These funds target improving teachers' educational level, internationalisation, the development of library and information services, enhancing IT (information technology) facilities, and career and recruitment services. In comparison, direct funding from the government to the universities covers some 70 per cent of their expenses.

Student Allowances. Students engaged in full-time post-compulsory studies lasting at least two months are eligible for financial aid. Studies entitling students to financial aid may be pursued in general upper secondary schools, folk high schools, vocational education establishments, AMK institutions or universities up to and including a doctorate. Financial aid is given also for studies abroad. Normal student financial aid consists of a student grant, a student housing allowance and a government guarantee for the student loan.

Curriculum Development. Professional expertise is constructed mainly in two environments: while the prerequisites for expertise are created in educational contexts, deep professional expertise develops in authentic working life. It is considered very important that the gap between educational environments and working life should be narrowed by different pedagogical innovations and by promoting co-operation between educational institutes and work places.

The traditional curricula of the polytechnics are based on the division between theory and practice. It is assumed that at first students have to acquire theoretical knowledge and later they would apply the knowledge in practice. Nowadays, the development of expertise is seen in a different way: learning knowledge and using knowledge are included in the same process than in separate processes. Learning is situated and typically takes place as the learner is participating in authentic practices (Eraut, Alderton, Cole, & Senker, 1998; Lave & Wenger, 1991; Resnick, 1987). Formal education occupies only a small proportion of the learning continuum and most learning experiences actually take place outside the educational institution (Candy & Crebert, 1991). As polytechnics are supposed to establish close relationships with working life and to participate in regional and local development programs, new teaching methods and co-operation with the surrounding community have been emphasized. One of the most widely applied pedagogical innovation in polytechnics has been project work which offers students meaningful forms of learning in collaboration with other students, teachers and representatives of working life (Blumenfeld, Soloway,Marx, Krajcik, Guzdial & Palincsar, 1991; Poell, Van der Krogt, & Warmerdam, 1998).

Learning Theories and the Relationship Between Education and Work

The interaction between education and work and intensifying students' participation in real life prac tices can be argued for on the basis of various learning theories. For example, sociocultural and situated learning theories have emphasised that learning takes place through participating in authentic practices and in social interaction (Darrah, 1995; Rogoff, 1991; Lave & Wenger, 1991), activity theory and developmental work research integrate learning and the development of work (Engeström, 1995), Dewey's classical notion of learning-by-doing highlights the significance o f concrete experiences and reflecting on them as do theories of experiential learning (Dewey, 19??; Kolb, 1984). Further, the notion of the reflective practitioner (Schön, 1987) and theories of informal and incidental learning (Marsick & Watkins, 1990) support the idea of learning actually taking place through work. The constructivist view of learning and cognitive research on expertise also provide important arguments for integrating education and work by emphasising the importance of the active role of the student and the integration of theoretical, practical and self-regulative knowledge (Mäkinen, Olkinuora & Tynjälä, 1999; Tynjälä, 1999).

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Motivational reasons for WBL have also been presented (Stasz & Stern, 1998) although research on WBL has not focussed much on motivational aspects or relied on motivational theories. A recent study on workplace learning (Poikela, 1999) identified four different types of how experts in an organisation oriented towards their work and the development of their expertise: 1) situationally orientated learning which means that problems are handled as they are met, without making preparations before; 2) action oriented learning which is based on analysing earlier experiences and ways of problem solving; 3) developmental learning orientation involving theoretical modelling of action and creating practical experiential knowledge; and 4) goal oriented learning related to the management of action in the framework of values, visions and goals set.

Research on learning and the development of expertise has followed two major pathways which Sfard (1998) has labelled as the acquisition metaphor and the participation metaphor. The former analyses learning as knowledge acquisition while the latter emphasises that learning is a process of becoming a member of a certain community and becoming able to communicate and participate within this community. The acquisition metaphor provides us with an understanding of individuals' cognitive knowledge construction while the participation metaphor involves a cultural view into the research on learning. These different paradigms may be seen as complementary views which both are needed in order to understand the nature of learning in general and work-based learning in particular. Thus, this study mostly follows Billett's (1996;1998) idea of integrating the cognitive constructivist and socio-cultural perspectives or the acquisition and the participation metaphors. It is assumed that learning and the development of expertise are knowledge construction processes taking place in reciprocal interaction between individuals and their socio-cultural environment. The union of cognitive and social constructivism, contextual and socio-cultural approaches are considered as a framework for developing expertise in the interface of education and work.

Student learning at work places involves many partners: students, teachers, workplace tutors, mentors, employers and employees working with students. It is assumed that the different partners in the co-operation between education and workplace may have different perceptions of what workplace learning or work-based learning is all about. For example, Candy & Mathews (1998) have explored the variety of perceptions of workplace learning and identified five different views: 1) the workplace as a site for formally accredited learning, 2) the workplace as a site for complex technical interactions and problem-solving, 3) the workplace as a site for sharing and creating knowledge, 4) the workplace as a part of the knowledge society and 5) the workplace as an organic entity, capable of learning and adaptation in its own right. Also the goals of WBL may vary. Hager (1998) distinguishes two main types of fundamental goals of different approaches to workplace learning: 1) the goal of personal growth and development and 2) the goal of developing human capital needed for a flourishing economy. Hager maintains that these different goals and perceptions of WBL are often in conflict. Therefore, it is important to analyse the various forms of education-working life interactions from the viewpoint of all parties or stakeholders, including students, teachers, tutors, employers and people working in enterprises providing work experiences for students.

Learning Processes in Constructing Expertise – Integrating Theory and Practice

Educating professionals different pedagogical solutions have developed, for example, problem-based learning (PBL), team work training, project -based learning, service learning, work related diploma work or master's thesis, applications of the apprenticeship, and many other forms of work-based learning (WBL). Although these different approaches are based on different theoretical frameworks, common to them is the idea of giving students practice in skills needed in real life, integrating theory and practice and enhancing the interaction between education and working life.

Expert knowledge consists of different elements, usually divided into three main components: 1) formal, theoretical knowledge, 2) informal, often tacit, practical knowledge and 3) self-regulative knowledge (Bereiter & Scardamalia, 1993; Eteläpelto & Light, 1999). Traditionally, different components of expert knowledge have been studied separately in the research of learning and expertise. While educational studies of school learning have focused on the acquisition of formal knowledge, the development of practical knowledge has been examined in working-life contexts. Self-regulative knowledge has received attention both from educational and working-life researchers, although theorists of adult education have discussed it in terms of reflective thinking and theorists of student learning in terms of metacognitive skills. In recent years, attention has begun to be paid to the importance of the integration of the different components of expert knowledge in learning and in the development of professional expertise (Bereiter & Scardamalia, 1993; Desforges, 1995; Leinhardt, McCarthy Young, & Merriman, 1995). Becoming a professional is not a process of substituting theory by experience but a process of fusing theory and experience (Bromme & Tillema, 1995). Accordingly, from the educational viewpoint the central question is how this integration takes place. Boshuizen, Schmidt, Custers & van de Wiel (1995) have shown that in the course of the development of expertise the detailed theoretical concepts acquired by students will be replaced by more general type of concepts that more or less summarise the detailed ones. This *process of knowledge encapsulation* is a result of repeated knowledge application in the context of practical experience. Leinhardt, McCarthy Yourn & Merriman,(1995) argue that true integration of theoretical and practical knowledge is best fostered when university students transform abstract theories and formal knowledge for use in practical situations and, correspondingly, when they employ their practical knowledge to construct principles and

conceptual models. Thus, *theorising practice* and *particularising theory* are suggested as the keys to the development of expert knowledge. Experiential learning theorists refer to this same process in terms of *reflection*: learning takes place through a cycle of experiences, reflection, conceptualisation and experimenting (Kolb, 1984). According to Bereiter and Scardamalia (1993), converting formal knowledge into an expert's informal knowledge and skills is pivotal in the development of expertise. This takes place when formal knowledge is used for *problem-solving*. Thus, problem-solving is considered a mediating tool for integration of different components of expert knowledge.

In the traditional polytechnic curriculum, theory and practice have been separated from each other and learnt in isolation. It is usual even today that there is no connection between theoretical courses and practice periods. Some theoretical and practical courses have same goals, but students have difficulties to integrate theory and practice. This type of traditional curriculum does not correspond with current views regarding the development of expertise. An integrated approach involving theorising practice, conceptualising practical experiences and developing self-regulative, meta-cognitive and reflective skills offers a more promising gateway towards expertise development (Leinhardt et al., 1995; Tynjälä, 1999). Getting students to cross boundaries between education and work through different forms of work-based learning seems to provide a promising starting point for developing prerequisites for professional expertise. However, this requires that true integration of theoretical, practical and self-regulative knowledge takes place and that students are really allowed to solve complex and ill-defined problems during their WBL periods. So far, the learning processes in work-based learning are vaguely known and we do not know whether WBL produces the integration of knowledge and what are the critical points that need further development. Therefore there is a need of intensive process-oriented studies in this area.

Project-Based Learning as a Form of Work-Based Learning

The term work-based learning has been used to refer to both employees' learning at their work (Keeling, Jones, & Botterill, 1998) and students' learning taking place through practice periods, working life oriented projects, excursions or other forms of working life connections (Trigwell & Reid, 1998; Clark & Whitelegg, 1998; Lasonen, 2000; Kivinen, Silvennoinen & Puustelli, 1999). In the USA, another educational approach similar to work-based learning is called service learning (Kahne & Westheimer, 1996; Sheckley & Keeton, 1997; Weigert, 1998). Common to WBL and service learning is the idea of learning-by-doing and emphasis on active, experiential and collaborative learning. In addition, both of them are based on the same variety of theoretical paradigms, such as Dewey's theories of learning and the experiential learning theory. Main differences between WBL and service learning is that the former emphasises the individual's occupational development whereas the latter is based on an ideological principle of serving the good of community and society.

There has been a lot of variety in polytechnic curricula in terms of their relationships to work. Traditionally in the school of health and social care the theory- and practice courses are alternated. Also the length of the practice courses differs. Altogether, WBL may take place in a variety of forms, such as in brief encounters, excursions, working life oriented projects, diploma works , sandwich courses, alternating sequence of placements, and student vacation or part-time employment.

Project-based learning (PBL) is a pedagogical innovation which applies the idea of integrating theory and practice by problem solving and by bringing working life problems closer to students (Askeland, 1997; Blumenfeld et al., 1991; Poell, Van der Krogt, & Warmerdam, 1998a; Poell, van der Krogt, & Wildemeersch, 1998b; Poell, van der Krogt, & Wildmeersch, 1999). In a project, learners work collaboratively on an actual (or simulated) real-life problem. This way students can apply theories into practice and learn group work as well as communication and co-operation skills in an authentic learning environment. It has been argued that project-based learning could overcome the disadvantages of both formal training and unstructured everyday learning while capitalising on their strengths (Poell et al., 1998a). Project - based learning has been studied in various environments. Poell et al (1998a) studied project -based learning in professional organizations, Peterson & Mayer (1995) studied PBL in counselor education, Ward & Tiessen (1997) studied PBL in Web:' Active learning with alive pages, Laffey, Tupper, Musser & Wedman (1998) studied ' A computer-Mediated Support System for PBL'.

In earlier forms of WBL the control remained essentially with polytechnic providers rather than with employers, and with tutors rather than students. Now there is a shift towards learning contracts, negotiated program content, and learner-managed three-way partnerships between the learner, the polytechnic and the employer, often based on real-time, work-based projects. According to Foster and Stephenson (1998), characteristic of these programs is the shift in program design and control from polytechnics towards employers and employees. Responsibility is shared amongst stakeholders, but the student has a key role in determining his or her own needs and aspirations. This way students' learning programs become integrated into their work activity. The provision of such customised education increases the scope for program innovation, but it also increases values conflicts both within and across stakeholding institutions exposing differences in expectations and experiences.

Hughes (1998) argues that the specific interests of students and employees may not be aligned, and the interests of both diverge from those of organisations and employers. For these reasons, it is important that the research on WBL covers the viewpoints of all stakeholders.

Foster and Stephenson (1998) have noted that student-managed WBL programs, such as real-time projects throw up a number of challenges for polytechnic, including definitions of suitable learning environments, the role of teacher, distribution of resources, the control of what is learnt and the establishment of standards of performance. A traditional control-oriented system in which student learning is predetermined by the teacher and subject boundaries does not work in situations in which content and learning methods derive from the needs of the project and the circumstances of the workplace. According to Foster and Stephenson (1998), in an ideal situation work-based learning is performance or task related including evaluation, problem-based, autonomously managed, team-based, concerned with company performance enhancement, and innovation centred.

The project-based learning method has been recommended in the AMK institutions for the following reasons: the pedagogical viewpoint: learning by the project-method in the polytechnic;
the social viewpoint: there are more and more multidisciplinary teamwork and projects in working life;
the policy of education viewpoint: financing education by the different forms of the funds of The European Union;
the viewpoint related to the theories of learning: the changing perceptions on learning; and
the professional viewpoint: to become an expert and improve one's know-how in working life.
One goal for polytechnic students is to learn project work skills with the help of project- based learning .

In this study *project -based learning* refers to one form and method of studying and learning, connecting theory and practice in such a way, that, at the same time, it is possible to learn project work skills. *Project work skills* mean qualifications which are one part of working life know-how. *Project work* means target-based development ventures between institutions of education and working life. In this study *a project* means a development task which is planned in advance, organised and budgeted, and the duration of which is defined. In a project students work in multidisciplinary teams.

Research questions and contexts

The road from the above principles and criteria emphasising study methods and the importance of developing the links between education and working life to alternative forms of work-based learning will be long and a great deal of development work will be required. There have been no studies in Finland of what links between AMK institutions and working life actually involve and what kind of impact promoting them will have on degree programmes and student learning. Therefore, the study will look for answers to the following research questions:

1. To what extent do programme administrators and teachers emphasise interaction between education and the workplace in three AMK institutions?
2. Which competencies and how will students on health care and social services programmes acquire through project-based learning?

The informants were selected to two case studies from three AMK institutions: Kajaani, Jyväskylä and Helsinki. The Department of Health and Social Care at the Jyväskylä Polytechnic launched a development project, SYTKE (Syty kehittymään ja kehittämään [Become inspired to develop yourself and others]), in 1998. The aim of the project is to promote employees' functional abilities in SME (small and medium-sized enterprises) in changing circumstances of working life by supporting work organisations in their development into self-directed learning organisations. The actors of the project are students and teachers of the Jyväskylä polytechnic and local social and health services personnel. The clients are the staff of twelve enterprises.

Data Collection and Method

Casestudy 1.

The first case study covered the most popular and modern degree programmes in the three largest study fields offered in AMK institutions. The degree of modernity was determined on the basis of, on the one hand, demand for labour in the relevant field and the field's international competitiveness and, on the other hand, innovativeness shown in developing teaching and studying methods on the programmes. The interviewees and the AMK institutions that they represented were based in Southern, Central and Northern Finland. These AMK institutions differed greatly also in terms of their size: Kajaani Polytechnic was a small, Jyväskylä Polytechnic a medium-sized and Helsinki Polytechnic a large multidisciplinary AMK institution. In each of these establishments, the director and principal tutor of and a lecturer teaching in a specific study field were interviewed. What follows is a description of the degree programmes examined.

At ***Kajaani Polytechnic*** the study covered the *Information Technology Degree Programme* delivered by the *Faculty of Engineering*. All engineering-related degree programmes are oriented towards practical work, including laboratory practice.

On qualifying as an engineer the graduate should have at least one year's practical work experience in engineering. This may be made up of the programme's own six-month work practice in addition to either work experience gained prior to beginning the programme or summer work undertaken during the summer vacations. Theoretical study and practical solutions are integrated in project work undertaken in collaboration with enterprises. (Kajaani Polytechnic, 2000).

Information technology engineers are trained to design, manufacture and market integrated-systems-based computers and signal processing systems. Such technologies are employed in data networks, such as mobile telephone networks, and in various measurement systems, such as those used in the paper industry. The studies last four years; they are equivalent to 160 credits, consisting of basic studies (50 credits), compulsory vocational studies (58 credits), optional studies (32 credits) and work practice (20 credits). The basic studies cover the essential mathematics and natural science required for work within this sector, and foreign language studies. Entrepreneurial and communication skills are also emphasised with a view to facilitating international contacts. The objective of the compulsory studies is to learn how to construct an integrated computer together with its peripheral devices and software. The principles of information and automation technology are also discussed. Optional studies cover the applications of integrated systems in data networks and in various areas of measurement technology. Students may use a part of their optional studies to broaden their knowledge of other subject areas by taking advantage of the range of courses in various subjects offered by other faculties of the polytechnic or by partnership institutions.

Kajaani region's most important industrial sector is forestry and wood processing. Tourism is also rapidly growing in significance. Kajaani's electronics companies and research establishments occupy a vanguard position within their sector, and their contacts with the town's various educational institutions are well developed.

At ***Jyväskylä Polytechnic*** the degree programme selected for the purposes of the present study was the *Global Business Management* programme offered by the *School of Business*. The Business Administration Degree Programme provides the student with skills and readinesses that enable them to work in expert positions in enterprises and the public administration and as entrepreneurs, and to develop their field, profession and themselves. The Business Administration and Business Information Degree Programmes lead to an AMK Degree in Business Studies, with graduates earning the title of *tradenomi*, AMK Graduate in Business Studies. The Global Business Management programme leads to the Bachelor of Business Administration degree. Those completing this programme are qualified to work as experts in managerial, developmental and advisory posts in enterprises, corporations and the public administration. They have also the readinesses required for setting up an enterprise of their own.

The School of Social and Health care offers studies leading to nine degrees, that of Bachelor of Nursing and AMK Degrees in Physiotherapy, Rehabilitation Case Management, Midwifery, Nursing, Social Care, Oral Hygiene, Public Health Nursing and Occupational Therapy. Nursing professionals are trained in patient care and undertake a variety of other studies involving co-ordination, planning and development in basic health care, specialised nursing or the private sector. Today nurses must have extensive capacities for multidisciplinary collaboration both in the domestic and the international arena. Based on this rationale, the Nursing Degree Programme seeks to produce internationally oriented nursing professionals for health and social care. The aim of the Social Care Degree Programme is to qualify students for special education and disability services, sociocultural work and early childhood education, and social pedagogy. The resulting expertise in customer services, management and development work is relevant particularly in social and health care but also in cultural and leisure services and in entrepreneurial and organisational activities. Annually about 50 students and some 15 teachers from the School of Health and Social Care participate in the exchange programmes.

Jyväskylä Polytechnic is a multidisciplinary corporation for teaching and learning also engaging in some research and development activities. It supports the growth of creative professionals towards expertise and initiative and promotes the know-how needed in the industries of Central Finland. The polytechnic trains students in all the seven study fields. There is also a vocational teacher education college

Jyväskylä Polytechnic is popular among young people both in neighbouring municipalities (60 per cent of all students) and elsewhere. In 1998 and 1999 the young voted it the most attractive polytechnic in the country (Jyväskylä Polytechnic, 2000). The total number of students exceeds 6,000. In addition to being one of the most interdisciplinary AMK institutions, Jyväskylä is also one of the most internationalised polytechnics in Finland. Four study fields include a full-length degree programme where tuition is in English. In addition, there are also many individual courses taught in English. Jyväskylä Polytechnic has partners all over the world. Typical co-operation activities include student and teacher exchange and institutional, educational and EU projects. In 1999-2001 Jyväskylä also co-ordinates the Finnish National Network of Universities and Polytechnics for East and South-East Asian Studies.

At ***Helsinki Polytechnic*** the survey covered *Mechanical Engineering*, a programme delivered by its *Institute of Technology*. The purpose of Helsinki Polytechnic is to increase professional expertise and promote improved competitiveness in the metropolitan area. Its activities are guided by the following principles: professional growth, stimulating work, excellence in action and customer orientation. Helsinki Polytechnic collaborates with the distinctive working life and business and industry of the metropolitan area and with national and international networks.

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Helsinki Polytechnic offers studies leading to 26 degrees in three different study fields: social and health care (50.5% of the students), technology (42.9%) and culture and services (6.6%), with a total enrolment of 6,164 in 1999 (Helsingin ammattikorkeakoulu, 2000). Entrants must have completed their general or vocational upper secondary education with a Certificate of Matriculation, a basic vocational qualification, or a tertiary-level college diploma, or have an AMK degree. The contents of all study fields are designed to qualify students for expert, developer, planning and managerial positions in working life. The polytechnic's research, developmental and service activities are similarly intended to meet the needs of working life (Helsinki Polytechnic, 2000).

The Degree Programme in Mechanical Engineering consists of the following options: Energy Engineering and Environmental Protection, Machine Automation, and Machine Design. Mechanical engineers work principally in product development and production engineering, in operating industrial plants and monitoring their functions, and in the planning, administration and management of project-based technical assignments.

The informants, a total of nine people, were interviewed by phone in February 2000. Each interview took about an hour. The selected AMK administrators and teachers were asked the following questions linked with instruction in occupation-specific skills and its function:

How far are decisions concerning the content and implementation of the curriculum based on the views of representatives of working life and on recognised qualifications?
How is a match between the curriculum and the changing needs of working life and of the immediate community ensured?
How are the outcomes of the curriculum linked with its contents and the students' working careers?
How are theory and practice being integrated in instruction?
What must the students learn in order to be able to apply what they have learned?
How are the students prepared for the work of the future?

Casestudy 2

The data for the study consists of students' learning journals, face-to-face and questinnaire interviews. In addition, the data also consists of teachers' video interviews and questionnaires. Table 1 shows the schedule of data collection among students.

Table 1. *Schedule of Data Collection*

STUDENTS:		
Spring 1999	March	questionnaire (38 were sent), returned 5
	May	learning journals 23
Autumn 1999	November	questionnaire (sent 39), returned 7
	December	learning journals 15
Spring 2000	March	e-mail questionnaire (12), returned 3
	May	interviews: 3.5, 18.5, 20.5 and 22.5 three teams (7+4+2)15 students and "case", 2 students
	May	learning journals 17
TEACHERS:		
Spring 2000	May	Video interview and questionnaire (8)
Autumn 2000	August	Video interview and questionnaire (11)

The data were analysed qualitatively by the phenomenographic method as described by Marton (1988,1995). A phenomenographic study focused on peoples' different perceptions of the surrounding world (Uljens, 1989). A phenomenographic study (Marton , 1982) tries to describe, analyse and understand peoples' experiences . Phenomenography describes the different ways in which people experience and conceptualise their real world and, on the basis of this, forms categories of description and seeks logical relations between these categories. (Uljens 1992 ja 1993).

In a phenomenographic study the researcher's *perspective* to the study is important. Marton (1994) writes about the perspectives of the first and the second level. The perspective of the first level means that the researcher orientates into the surrounding world and makes conclusions. The perspective of the second level (which phenomenography is interested in) means the researchers' orientation to peoples' thoughts, perceptions and experiences of the surrounding world and making conclusions on the basis of that. A perception means giving significance to a phenomenon. So, perceptions describe the relation between a person and his surroundings (Uljens 1989).

The results of a phenomenographic study are the categories the researcher formulates based on the analyses. These categories describe the variety of the perceptions in the data. The categories are formed based on the data by describing the features and structures present there. Theorists have presented somewhat differing descriptions of the stages of the analysis (e.g. Marton 1988, Uljens 1991). In a phenomenographic analysis (as also in qualitative study in general) there are no clear structures of progress. In the process of analysis it is essential that the researcher reads the data repeatedly reflecting on his own understanding of the data and on the experience gained from it. (Larsson 1986; Uljens 1992).

The analysis in this study progressed as follows:

1. At first the learning journals were repeatedly read in order to determine the distinct ways in which the students described their learning in a project called the SYTKE -project .
2. After that meaningful expressions related to the research questions of this study were brought up.
3. An important stage of the analysis is the creation of, as Marton (1988) terms them, the 'pools of meanings' . The characteristics of the meanings in the pools were compared. The criteria for each category were formed. When two expressions differed at the word level but contained the same meaning, they were placed into the same category. It is important to note that the categories do not exclude each other at the level of an individual subject. This means that each expression may be entered under more than one category.
4. The categories were tested with regard to the original data by forming codes for the categories. The whole data were coded and thus it was possible place each expression in a formulated category. Hence, the categories resulting from the analysis covered the whole variation of the different ways in which the students described their subjective perceptions of learning in the project. (Marton 1988;1995; Häkkinen 1996, Uljens 1989). One important point is that these categories, like categories in phenomenographic research in general, do not represent the types of individuals. Instead, they are the forms of understanding a certain phenomenon that individuals express in their speech, or, as in this case, in their writing.

The categories are the results in a phenomenographic study. In this study the aim is to take the analysis further towards a more comprehensive interpretation of project learning and working life skills. One step towards that end is a reorganisation of the categories on the basis of more theoretical concepts.

Results

Students' perceptions of the goals of learning in the project

On the basis of the first classifying criterion a distinction between very brief expressions and comprehensive ones was made. Examples of the categories follow:

The description category 1: *"My goal is to learn project work and multidisciplinary collaboration."*

The description category2: *" My goal is to make my knowledge on the employees' functional abilities deeper. .. to learn by connecting theory and practice and to solve problems... help the employers and employees to find their problems and to make changes by explaining their beneficial impact. .. to extend my knowledge also beyond my education...to acquaint myself with the tests.."*

Students described their learning with the following, qualitatively different, verbs. The expressions also show how individually different perceptions the students have on learning in a project: *To perceive to follow to be with to participate to be a part to get to know to get to do to practise to learn to observe to observe to know to understand to get experience to be trainedto get readinessto acquaint oneself to deepen and strengthen know-how to extend viewpoints to get abilities for the future to evaluate to applyto develop to grow into a professional*

After that four different categories of the descriptions of learning goals could be identified. They related to the descriptions of learning, social and professional conduct and the regulation of one's conduct. These categories were, furthermore, named more theoretically: (1) the style of learning (2) social orientation, (3) professional orientation and (4) locus of control with their subcategories as shown in Table 2.

Table 2: *Descriptions of the main and sub-categories of goals*

Style of learning	***Social orientation***	***Professional orientation***	***Control of action***
Deep level process orientation *Task and surface level orientation*	*Collaboration and self-direction* *Role and position in project*	*Working with clients and working life collaboration* *Developing expertise*	*Self regulation* *Regulation of resources*

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The categories are horizontally related to each other. The following is a presentation of only the categories and their criteria:

Style of learning

- Deep level process orientation
  The goals are specific, hierarchical, wide, holistic and linked with the distant goals.
  Learning is described as problem solving or as a progressive process advancing to an ever deeper understanding.
  The goals here are understanding and finding meanings and motivation for developing oneself.
  The expression of goals shows an attempt to connect and apply theory and practice.
- Surface level task orientation
  The goals are general, brief, distant, the same as those written in the curriculum. The goal expressed as only one or few tasks. Action is perceived as simply having the task done.

Social orientation

- Collaboration and self-direction
  Orientation to oneself and others is expressed. In addition, awareness of the interactive and collaborative nature of learning as well as of its independence can be seen .
- Role and position in the project
  Expressions related to different roles of action and position.

Professional orientation

- Working with clients and collaboration with working life
  Expressions related to professional activities and references to working with clients and to collaboration with working life
- Developing expertise
  Action is expressed as professional development.

Locus of Control

- Self regulation
  Intentional and metacognitive regulation expressed: the level of goals and learning is defined, also expressions related to effectiveness and the sense of responsibility.
- Regulation of the resources
  Regulation of efforts and time expressed. Definition of one's tasks in relation to the overall aims of the project.

Students' Perceptions of Their Know-How in Working Life Promoted by the Project Work

In this study the *know-how in working life* means the combination of the concepts of qualification, competence, professional skills and expertise. The initial analyses of the students' learning journals (55) showed that the students notions on know-how in working life and on its development by working in a project varied greatly. The analysis will go on, as above, by finding 'the pools of meaning' which describe the students' perceptions of know-how in working life and its development. The first classifying criterion was the significance of project work in relation to the discipline the student was studying. Next, description categories were formed related to the following items: (1) working life skills, (2) working with clients, (3) self- knowledge, (4) challenges for personal development, (5) reflective thinking, (6) self-control and (7) developing to an expert. At the following stage, the students' statements were interpreted and concepts of a higher theoretical level were formed. The quotations show the relation between the data and the categories.

Working in a project gave confidence, experience on appearing in front of a group, independence, taught effectiveness, autonomy, initiative and persistence. Project work demanded drawing up goals, innovation and active approach, looking for information and being patient.

The qualifications the students expressed were both general and special vocational skills. The students got skills of working with autonomy and with a sense of responsibility. They had learned team work skills and different skills of collaboration. The students also expressed their perceptions on their self-knowledge, self-confidence, reflective and critical thinking and challenges for self-development. Furthermore, descriptions of self-regulation related to the use of time, efforts and action were also expressed.

An important qualification is the skill of working with clients. In their learning journals the students described their perceptions of working with clients related to the needs of the clients and to collaboration on an equal basis.

First the students were asked by e-mail to answer one question: How does project work promote know-how in working life ? The following categories were formed on the basis of the above answers:

(1) related to the curricula
(2) related to the organisation of teaching
(3) related to the teaching activities
(4) related to collaboration
(5) related to the personal characteristics of the students

Feedback was also received from the teachers and the employees of the working life partners.

Skills and characters based on the description categories

The following theoretical categories were formed on the basis of the descriptions of learning and working life know-how. These categories describe the skills needed in working life: (1) the skills of self-regulation. (2) skills of communication , (3) skills of collaboration , (4) professional skills, (5) skills of marketing, (6) skills of international collaboration, (7) skills of developing oneself and (8) development skills.

Table 3. *Skills and characters of an expert*

Skills	Characteristic of expert
1. Skills of self-regulation:	
Regulating resources (time, efforts, situation of life, career development etc.)	Self-confidence, independent ,
Developing self-knowledge	effectiveness, initiative, patience,
Attaining goals	activity, independence and
Coping with tasks	ability to bear conflicts
2. Skills of communication:	
Negotiation skills	
Presentation skills	Ability to listen each other
Interactive skills	
Skills of written communication	
Skills of influence	
Information skills	
Computer-skills	
3. Skills of collaboration :	
Multidisciplinary teamwork skills	Flexibility, purposefulness,
Skills of project work	responsibility
Skills of network	
Collaboration with working life	
Conflict management	
Organization skills	
Skills of coordination	
Leadership and management skills	
Skills of getting feedback	
Skills of evaluating peers	
4. Professional skills (in this context related to the social and health branch)	
Hands-on skills	Empathic,
Skills of certain tasks and procedures (competence)	readiness to be of service,
Skills of client work	good behavior
Skills of sharing expertise (e.g. teaching each other)	
Understanding of professional ethic	
5. Skills of marketing	
Skills of employ oneself	Skills of marketing oneself
Skills of enterpreneurship	
Confidence of costs	
6. Skills of international collaboration	
Skills of receive international challenges	Multicultural understanding
Knowledge of languages	
7. Skills of developing oneself	
Learning to learn and develop oneself	Self-directing
Self- evaluation and reflective thinking	Capable of development oneself
Skills of receiving feedback	
Skills of develop one's self-confidence	
8. Development skills	
Planning skills	Creativity
Problem solving skills	Innovation
Readiness to make changes	Courage
Skills related to 'sustainable development'	Ability to bear uncertainty
	Ability to be visionary

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The Project as a Pedagogical Learning and Tutoring Process

This phenomenographic research studies learning. Learning is perceived as a qualitative change in learners' structure of knowledge. The learners' relation to the surrounding world changes when they are organising it in greater detail and in depth. The learners' structure of knowledge determines how they learn new data in future. (Marton & Wenestam 1984.) From the didactic viewpoint, perceptions are structures of knowledge in a stage of development. This development is promoted by interaction with teachers, trainers and other experienced employees (Lasonen, 2000). The importance of a teacher lies in the fact that he represents structures of knowledge and perceptions which are on a higher level of organisation than those held by students. The following terms are used to describe the differing levels of the structures of knowledge between teachers and students:

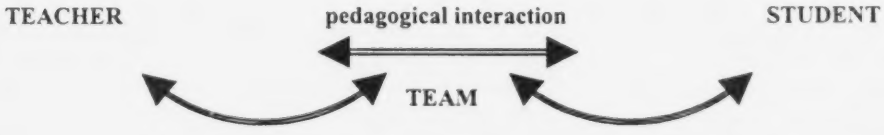
spontaneous perception ——————— educated perception

perception of a novice ——————— perception of an expert

lay perception ——————— scientific perception

During interaction an expert's educated and scientific understanding moulds the novice's spontaneous everyday perception. These perceptions then gradually approach each other. The teacher must be conscious of the student's spontaneous perception. That is why the teacher has to know the student's starting position and goals. Furthermore, the teacher must be aware of the student's needs of tutoring. If this is not the case, the student's spontaneous understanding cannot be made use of, and so the two perceptions will never meet. (Ahonen 1995; Vygotski 1934/1982.)

In their learning journals the students expressed a variety of different ideas related to tutoring and the role of teams in the project. These perceptions are important because the interpretations and conclusions based on them form the basis for the development of project-based pedagogy (Figure1). Furthermore teams where students studied were important promoting factors during learning in the project. Learning in teams is special in project based learning.



TEACHER	TEAM	STUDENT
Tasks and role	*Role*	*Tasks*
Has the know-how of project work.	"A team is teaching": as shared expertise	Asks for help in need
Is conscious of the students' needs.	"A team supports its members"	Finds out about things independently
Provides the basic orientation for the students	"A team is safe": it creates safety	Takes responsibility
Is flexibly available	" A team motivates"	Shows autonomy of action
Makes the students take responsibility	*Possibilities by learning in a team:*	Doesn't lean too much on the teacher
Promote studying	To learn collaborative learning	
Doesn't give ready-made solutions	To learn skills of teamwork	
Gives guidance and support	To learn attain goals common of a team	
Tutors students at different times and on different levels, and in different tasks, in their personal curricula, in self- and peer-evaluation	To learn equality acting	
Tutors students in planning their timetables and in time management	To learn working in multidisciplinary teams	
Encourages collaboration	To learn work sharing	
Tutors multidisciplinary teams	To learn working in different roles	
Tutors documentation	To learn response sharing	
Acts in teams on the basis of equal partnership	To learn feedback giving	
Gives feedback	To learn peer evaluation	

Figure 1: *Perceptions on tutoring in a project as expressed by teachers and students*

Students' perceptions on the critical points of project-based learning in which the significance of tutoring was important in relation to :

- the orientation towards project-based learning
- the professional substance: (knowledge - skills - qualifications - affections)
- the tutoring of the process of studying
- the organisation of a project.

Conclusions

The case study involved an analysis of how the people responsible for the AMK curriculum see the interaction between education and work. The daily activities of educational establishments are about carrying out the curriculum. Accordingly, the people selected as subjects of the case study were asked how much influence representatives of working life are able exert on the implementation of the curriculum, how good a match there is between the instruction delivered by the polytechnic and working life, about the integration of theory and work and about the future orientation of the curriculum.

Most of the respondents (78%) considered that the contents of the curricula have been shaped by representatives of working life and consultative committees, but above all by the qualifications needed at work. In addition, particularly those responsible for the curriculum are themselves members of local enterprises' boards of directors. Students do their practical assignments and carry out research under the supervision of their teachers and in collaboration with enterprises. In business education representatives of working life evaluate the curricula every two or three years. All the respondents considered that a match between the curricula in their field and working life is ensured. Giving up field-specific teaching methods that have become set in a fixed mould (eg an engineer-like approach to classroom instruction) was considered a starting point for improvement. Every teacher should work in industry every fifth year. The basic structure of the curriculum comes from working life, but its implementation is based on pedagogic decisions and paying attention to each student's individual needs. A modular curriculum is flexible and can be reorganised quickly. All student programmes include an obligatory work practice period.

After graduation students from these fields find jobs easily, particularly the software technology graduates. The IT programme is based on the criterion that a student must be able to find a job anywhere in the world. All respondents take the integration of theory and practice for granted. It is promoted by such things as work practice and laboratory exercises, intended to foster holistic and integrative learning. According to the respondents, the content of the curriculum is based on what is happening in working life. Students should accumulate situation-specific learning experiences that will help them to transfer their learning to their future professional environments.

The contents of the curriculum and the decisions about its implementation pay attention to a future perspective. The respondents claimed that the curricula of the technical fields are changing every year or two because the enterprises demand it. Maintaining the competitiveness of industry is reflected in the standards of instruction. From the point of view of a student's future prospects, doing one's thesis in collaboration with an enterprise is an important stage in finding a job and gaining a comprehensive understanding of the various aspects of one's profession. Work practice helps students to create a useful network of enterprises. At the same time, it is difficult to predict the future because we never know in detail what it will be like. All the same, the future is always there and we are working with it in mind.

The analysis of the learning process was guided by learning diaries where the students (N=55) described their learning during the project from goal-setting to evaluation. Most of the students (65%) expressed a willingness to learn to work in projects. The students' goal descriptions yielded the following main categories: (1) learning style, (2) social orientation, (3) vocational orientation and (4) locus of control. Thus, the students considered project work an important tool of social and vocational learning.

In the present study, working life competence refers to a comprehensive picture of the practical competence required in current and future working life that emerges through a synthesis of the concepts of professional skill, competence, qualification and expertise. Further, the notes made by the students in their learning diaries were used to analyse what kind of conceptions the students had of working life competence and of how it develops in project work. Their descriptions of learning and working life competence foregrounded the following skills: (1) occupation-specific skills, (2) self-regulation skills, (3) communication skills, (4) the various areas of collaboration skills and (5) developmental skills.

Because of a lack of time, workplace supervision of the students was inadequate. It is possible that this is partly due also to a lack of supervisory skills among both the teachers and the workplace trainers. In supervising goal-setting, attention should be paid to different target areas and levels, the studying process as a whole, the different contexts of learning, collaboration, self-directedness and -regulation, resources management and motivation. As regards supervision methods, cognitive and social resources and resources related to resources management, and the intensity of activities are of particular importance. Supervision of activities covers an analysis of the assignments set for the students, the conscious nature of learning, sources of motivation, factors promoting and hampering learning, various approaches to learning, teamwork and multidisciplinary collaboration, and the integration of theory and practice. As

regards developing evaluation, attention must be paid to how feedback is given and received, evaluation methods (eg self-evaluation, peer evaluation and indicating how learning outcomes are linked with learning targets. Integrating the principles of work-based learning to the entire curriculum should be a natural aspect of the curriculum and daily activities of the educational establishment.

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